

Fall 2002

The Effects of an Induced Negative Mood State on Ground- Based Learning in Student Pilots

Angela Sophia Wendell
Embry-Riddle Aeronautical University - Daytona Beach

Follow this and additional works at: <https://commons.erau.edu/db-theses>



Part of the [Aviation Commons](#), and the [Cognition and Perception Commons](#)

Scholarly Commons Citation

Wendell, Angela Sophia, "The Effects of an Induced Negative Mood State on Ground- Based Learning in Student Pilots" (2002). *Theses - Daytona Beach*. 211.
<https://commons.erau.edu/db-theses/211>

This thesis is brought to you for free and open access by Embry-Riddle Aeronautical University – Daytona Beach at ERAU Scholarly Commons. It has been accepted for inclusion in the Theses - Daytona Beach collection by an authorized administrator of ERAU Scholarly Commons. For more information, please contact commons@erau.edu.

THE EFFECTS OF AN INDUCED NEGATIVE MOOD STATE ON GROUND
BASED LEARNING IN STUDENT PILOTS

by

Angela S. Wendell

A Thesis Submitted to the
Department of Human Factors & Systems
in Partial Fulfillment of the Requirement for the Degree of
Master of Science in Human Factors & Systems
Embry-Riddle Aeronautical University
Daytona Beach, Florida

Fall 2002

UMI Number: EP31883

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI[®]

UMI Microform EP31883
Copyright 2011 by ProQuest LLC
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

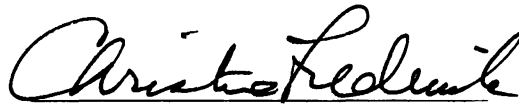
THE EFFECTS OF AN INDUCED NEGATIVE MOOD STATE ON GROUND
BASED LEARNING IN STUDENT PILOTS

by

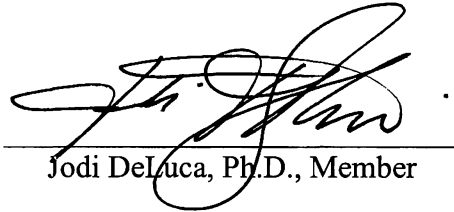
Angela S. Wendell

This thesis was prepared under the direction of the candidate's thesis committee chair, Christina Frederick, Ph. D., Department of Human Factors & Systems, and has been approved by the members of the thesis committee. It was submitted to the Department of Human Factors & Systems and has been accepted in partial fulfillment of the requirements for the degree of Master of Science in Human Factors & Systems.

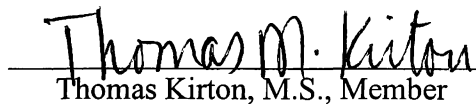
THESIS COMMITTEE



Christina Frederick, Ph.D., Chair



Jodi DeLuca, Ph.D., Member



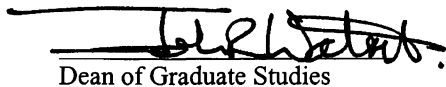
Thomas Kirton, M.S., Member



MS HFS Program Coordinator



Department Chair, Department of Human Factors & Systems



Dean of Graduate Studies

Acknowledgements

The author wishes to express appreciation to committee members Thomas Kirton and Dr. Jodi DeLuca for their comments, suggestions and feedback. Appreciation is also due to the dedicated assistance of the librarians at Embry-Riddle Aeronautical University, who helped to search the world for literature and research. A very special thanks is owed to Cheryl Urquhart and Suzanne Robinson whose unrelenting help made the timely completion of this project possible. Finally, deep gratitude is owed to Dr. Christina Frederick, whose support, encouragement, and appreciation for deadlines helped lead to the completion of this research.

Abstract

Author: Angela Sophia Wendell

Title: The Effects of an Induced Negative Mood State on Ground- Based Learning in
Student Pilots.

Institution: Embry-Riddle Aeronautical University.

Degree: Master of Science in Human Factors & Systems

Year: 2002

The United States Department of Transportation and the Federal Aviation Administration's *Aviation Instructors Handbook* (D.O.T.) (1999) emphasizes that aviation students must maintain a healthy and positive state of mind in order to succeed at learning. Factors such as worry, lack of interest, physical discomfort, and anxiety are all listed as obstacles to a student's ability to learn successfully during flight instruction. In addition, numerous studies support the idea that a negative mood state will have a detrimental effect on learning. This study attempts to investigate the effects of an induced negative mood state on ground- based learning in student pilots.

Table of Contents

Abstract	iv
List of Tables	vii
List of Figures	viii
Introduction	1
Memory	3
Mood and Memory	5
Empirical Evidence	7
Learning and Memory	11
Student Pilot Learning	15
Mood Induction	22
Screening for Depression: Ethics of Mood Induction	26
Assessing Mood Induction	27
The Present Study	28
Method	30
Participants	30
Materials and Apparatus	30
Screening Procedure	32
Mood Induction and Assessment	32
Design and Analysis	33
Procedure	34
Post Testing	36
Results	37

Discussion	41
Conclusion	43
References	44
Appendices	
Appendix A Recruitment Script	50
Appendix B Consent Form	52
Appendix C Initial Student Questionnaire	54
Appendix D Beck Depression Inventory	56
Appendix E Velten Mood Statements	61
Appendix F Complex Aviation Sentences	65

List of Tables

Table 1: Descriptive Statistics	38
Table 2: Analysis of Variance of Mood vs. Sentence Type on Recall	39

List of Figures

Figure 1: Graph showing recall of target words from elaborated and base sentence types	40
---	----

Introduction

“Do you understand the new lesson concepts from this teaching session?” I asked my student as he sat staring at me with a blank look in his eye. It was evident that he was not completely focused on the lesson being taught. Although normally an enthusiastic beginning flight student, he seemed depressed and in a negative state of mind today. Upon quizzing the flight student at the end of the lesson, it was obvious that he was not retaining very much of the new information which had recently been presented.

The United States Department of Transportation (D.O.T.) and the Federal Aviation Administration’s (FAA) *Aviation Instructors Handbook* (1999) emphasize that aviation students must maintain a healthy and positive state of mind in order to succeed at learning. Factors such as worry, complacency, lack of interest, physical discomfort, and anxiety are all listed as obstacles to a student’s ability to learn successfully during flight instruction. Interestingly, the D.O.T. has set medical guidelines in its Federal Aviation Regulations/ Airman’s Information Manual (FAR/AIM [2002]) concerning a student’s psychological state of mind and the ability to receive his/her pilot medical certification and student pilot certificate. Of particular interest is the potential occurrence of a negative mood state similar to those variables evident in decreased student pilot learning performance. Although mood and a negative mental state are discussed in many flight instructor teaching manuals, it is generally a topic that is only briefly mentioned. Flight instructors are warned, and essentially recommended, to take note of students who appear to be psychologically compromised (Telfer, & Biggs, 1988; Jensen & Adrion, 1985; U.S. D.O.T. 1997).

The study of aviation is often thought of as a “manual oriented flight training program,” however, all pilots are required to develop an extensive knowledge base of aviation related material during ground instruction. Some of this ground-based knowledge includes developing an understanding of weather, aircraft systems, flight planning, aircraft performance, and radio communications (D.O.T. 2002). For the average beginning student pilot, this material is relatively new, complex, and quite overwhelming (Tessonneau, 1973). Furthermore, the learning of new information generally requires a higher level of concentration for most student pilots (Squire, Byrne, Nadel, Roediger, Schacter & Thompson, 1992), particularly those seeking a flight certificate. If the student pilot is burdened by distractions, especially those involving emotional content, during the ground learning process, then the student may not be able to achieve the high level of concentration needed in order to retain the important aviation concepts (D.O.T. 1999).

This study will attempt to answer the question, “how does a negative mood affect a student pilot’s ability to learn ground- based material?” For the purpose of this study, a negative mood state shall be defined as a mood state that is not positive or constructive (Mish & Morse, 1994). The paper will address the relationship between mood and memory, as well as how a negative mood state may affect a student’s ability to learn during ground-based instruction. Finally, mood induction techniques and mood testing strategies will be addressed in regards to the proposed study.

Memory

Over the years, there have been many debates as to whether memory is divided into multiple systems, or if it exists as a single system. The main focus of this debate tends to be on distinguishing between short-term memory and long-term memory (Searleman & Herrmann, 1994). In general, however, short-term memory is characterized by a shorter duration of retention, a smaller capacity for information, and a way of coding information that tends to be acoustic in nature. Items stored in short-term memory usually will be forgotten in 30 seconds if not rehearsed. An individual may, however, be able to retain information stored in short-term memory for a long period of time if that information is continuously rehearsed (Fisk & Schneider, 1984). Likewise, the capacity of short-term memory is limited to about seven items. Finally, short-term memory is usually encoded by using sound patterns and acoustics. (Ellis & Hunt, 1989; Squire et al., 1992; Searleman & Hermann, 1994).

Long-term memory, in comparison, is characterized by a longer duration of retention, a virtually unlimited capacity for new information, and a semantic system of processing information (Squire et al., 1992). Although it is sometimes difficult for humans to recall stored information, knowledge stored in the long-term memory has been stored indefinitely (Searleman & Hermann, 1994). In addition, long-term memory has an enormous capacity for information. All of our knowledge about the world is stored in long-term memory. Another of the main differences between short-term memory and long-term memory is the way in which information is coded. While short-term memory information is coded using sound patterns, long-term memory encoding is based on

semantic cues (Squire et al., 1992). Semantic memory describes information that does not have a specific memory time limit. Retrieval from semantic memory is also not based on encoding specificity. This means that one need not remember the exact occurrence of events in which they acquired the knowledge in order to bring forth that information (Ellis & Hunt, 1989).

In relating short-term memory and long-term memory to student pilot encoding, the majority of all student knowledge must be recorded in long-term memory (U.S. D.O.T., 1980). In the study of aviation, there are very few concepts that can be continuously rehearsed in order to be recalled at a later time. Likewise, FAA standards require student pilots to remember an abundance of information (D.O.T. 2002). While short-term memory will generally only retain about seven items, long-term memory is able to retain a virtually infinite amount of information. The ability of the student pilot to retain a great deal of information requires the use of long-term memory rather than short-term memory. Finally, semantic processing must be used in order to facilitate storage of the majority of knowledge that a student pilot must retain. While processing information by using sounds may help aid in the repetition of certain aviation vocabulary, a student will not likely be able to remember most of the material based on acoustics alone.

Time of Day. A brief mention should be made concerning retrieval from semantic memory at different times of the day. A study by Tilley and Warren served to show that retrieval is more efficient in the evening, versus earlier times of the day (1983). This may be due to the circadian increase in physical arousal (indicated by an increase in body temperature) which rises from a low level in the morning, to a higher peak in the evening. This suggests that memory retrieval strategies used in the morning should try to

minimize the cognitive load and effort, due to the state of low circadian arousal (Tilley & Warren, 1983). Unfortunately, the majority of students are forced to retrieve information from the semantic memory at all different times of the day. In studying and testing, however, it may be beneficial to retrieve similar sets of information at a relatively constant time of day, (i.e. morning versus afternoon or evening) rather than recalling the same information in the morning on one day, and during the evening on another day.

Mood and Memory

Mood and emotion are words that can be used together, as a mood is feeling state. (Christianson, 1992). Emotion, then, may be defined as a transitory state of feeling that can vary in both quality and intensity (Searleman & Hermann, 1994). In turn, these emotional states, or moods, are associated with a change in arousal level. Sometimes this arousal level will be higher, while other times the arousal is lower. An abundance of studies have been performed in order to show the relationship between mood and memory (Asuncion & Lam, 1995; Parrott & Sabini, 1990; Hertel & Hardin, 1990; Ellis, Lewis & Williams, 1989; Thomas & Rodriguez, 1984; Clark, Milberg & Ross, 1983; Leight & Ellis, 1981). Such studies use various forms of mood induction techniques in an attempt to show how different mood states may affect an individual's ability to remember a variety of verbal and written items. In these studies, a negative mood state has been shown to disrupt the normal cognitive processing that would occur in a healthy individual. Several theories have attempted to explain these findings. One popular explanation is called the resource allocation hypothesis (Ellis & Ashbrook, 1988; Hasher & Zacks, 1979). This hypothesis is based on the assumption that a person is only able to

use a limited number of cognitive resources when performing a mental task. In turn, the available resources needed to solve the mental task may be reduced when an individual is in a negative state of mind. The negative state of mind may cause the individual's attention to be focused on something other than the presented mental task. This, however, has been shown to occur only when the memory task is somewhat complex in nature and includes elaborative (vs. simple) encoding (Weingartner et al., 1981; Ellis et al., 1984). In essence, the resource allocation hypothesis says that individuals who are suffering from a negative mood state will show a lower performance level on memory tasks that require complex cognitive demands, due to limited mental resources.

In addition to the resource allocation hypothesis, several other possibilities have been suggested in an attempt to explain the reduction in memory capability found to occur when an individual is in a negative mood state (Hertel, 1990; Hertel & Hardin, 1990; Guenther, 1988; Johnson & Magaro, 1987). A study performed by Hertel and Hardin (1990) suggests that an individual in a negative mood state may simply have a lower initiative to remember, rather than diminished cognitive resources. Likewise, sad people may be lacking in the ability to spontaneously initiate the required strategies to aid in memory retention. These findings suggest that a lack of motivation is strongly correlated with memory retention and processing. (Hertel, 1992).

Another possible explanation for the decrease in memory performance was proposed by Guenther (1988). This theory suggests that individuals in a negative mood state are simply consumed by their own thoughts and feelings. These people may be able to use the proper cognitive resources, but are unwilling or unmotivated to do so (Guenther, 1988). Finally, one other theory proposes that individuals in a negative mood

state may simply be changing their responses in order to be more conservative in answering the questions (Johnson & Magaro, 1987). In this case, a person in a negative mood state may remember the correct answer, but be hesitant about guessing incorrectly. This may cause one to believe that the individual has not remembered the information, when in actuality, the questions are simply not being answered correctly. Although theories regarding the reduced memory capacity may vary, they each maintain that a negative mood state will likely lead to an impairment on complex memory tasks.

Empirical Evidence

One of the first major studies performed on emotional mood states and memory was done by Leigh and Ellis in 1981. The study sought to examine three main questions:

- 1- How do various mood states affect the organizational processes in memory?
- 2- How is information coded when an individual is in a particular mood?
- 3- How does the emotional state one learns in affect the retrieval process later on?

Although prior studies had suggested that emotion and cognition were linked, most of these investigations involved patients who were clinically depressed, rather than participants who had undergone a temporarily induced mood state (Ellis & Hunt, 1989). When testing clinically depressed participants, it may be difficult to tell if the effects of the test are caused by the mood state, or if the effects are a result of another symptom associated with clinical depression (Ellis & Ashbrook, 1989). Furthermore, there is a limit to the generalizability of such studies, particularly when examining the student population. Bowers (1987) found that the majority of individuals without clinical

depression have experienced fluctuations in their mood from day to day. Therefore, it would appear that, in order to represent the non- clinically depressed population, a temporary state of depression would need to be induced.

In the study performed by Leigh and Ellis (1981), the effects of experimentally induced mood states on recall and the chunking of letter sequences was examined. The results of the study showed that subjects in the neutral mood condition had higher performance on the recall task than those in the sad mood condition. The results indicate that a sad emotional state may interfere with encoding. Several years later, Ellis, Thomas and Rodruetz (1984) performed a more thorough version of the earlier study. The new study involved the examination of mood effects on elaborative encoding. The elaboration hypothesis proposed that deeper levels of processing would result in increased retention due to the more complex encoding of the information (Searleman & Herrmann, 1994).

In the Ellis et al. study, (1984) participants were also put into various mood states using a mood induction technique. Participants were then presented with either base sentences, or elaborated sentences. The base sentences consisted of simple, coherent sentences, such as, “The hungry child opened the door.” After reading this sentence, the participant would later see the same sentence with the target word, “hungry” missing. The elaborated sentences included the base sentence, plus a phrase which contained information that elaborated upon a target word in the sentence. The elaborated sentence might be, “The hungry child opened the door of the refrigerator.” In the elaborated sentence, the participant was still required to later remember the word “hungry.” In the elaborated condition, however, the word refrigerator was used in order to help bring out

distinctive properties of the target word. This was proposed to help aid in memory retention. The task was an incidental memory procedure, meaning that the participants were not told exactly what they were suppose to remember in the presented sentences. The participants, therefore, were not able to focus their attention on a specific part of the sentence. Instead, they were forced to examine the sentences in their entirety, in order to broaden the complexity of the task.

The results of the study showed a clear interaction between mood states and the processing of various sentence conditions. In comparing the sad and neutral mood states, participants in the depressed state showed a significant reduction in the recall of target words in comparison to subjects in the neutral condition. In addition, more target words in the elaborated condition were remembered by both groups, although the neutral subjects remembered significantly more. The study confirms the hypothesis that individuals in a depressed mood state will have a difficult time processing and remembering information (Ellis, Thomas & Rodriguez, 1984).

Caffeine, Diet and Age. Several other factors that may affect mood deserve a brief discussion. For instance, when caffeine is given to a healthy individual, it is said to enhance both mood and memory (Squire et al., 1992). People may have a better sense of well-being after ingesting caffeine. Participants may also be calmer, more alert, and more interested in the experiment (Squire et al., 1992). A study by Loke, Hinrichs and Ghoneim, however, attempted to look into the effects of caffeine on mood and memory more closely (1985). The study used 108 young, healthy adults who were moderate caffeine users. The participants were told to have a normal night's sleep the night before the test, and to abstain from caffeinated beverages, alcohol and drugs (such as marijuana)

for 28 hours before the testing. Likewise, the participants were told to abstain from consuming food for 6 hours before the testing began. Oral administration of caffeine (0, 3 and 6 mg.kg) was given to the participants after an initial test had been completed. Tasks the participants were told to perform included addition, symbol cancellation, card sorting, etc. The results of the study showed that caffeine had no effect on mood, cognitive skills, learning, or memory performance. There was, however, a slight increase in anxiety and tenseness as noted by the subjective reports. Likewise, there was a slight impairment in fine motor coordination, likely related to the “jitters” that were reported with the higher levels of caffeine administration (Loke et al., 1985). It seems, however, that for a normal, healthy, college student, low doses of caffeine should not have a large impact on mood and memory performance.

Compared to younger individuals, elderly people are usually shown to have a deterioration in memory functions (Searleman & Hermann, 1994). A decline in memory storage, reduced memory processing speeds, and a decline in retrieval all may occur because of changes in neuro- endocrine functioning during the aging process, which can cause a reduction in the signal/ noise ratio (Christianson, 1992) In addition to age, diet has been suggested to have an effect on mood and memory (Deijen et al., 1992). Research concerning diet generally investigates the relationship between vitamin status and behavior. Many of the studies are also performed on older participants (Deijen et al., 1992; Searleman & Hermann, 1994). For example, a study by Deijen et al. (1992) showed that vitamin B-6 supplementation might modestly improve the storage of information in older men. A study performed on healthy young males investigated the effects of thiamin, riboflavin, vitamin B-12, vitamin C, vitamin E, and folic acid (Heseker

& Kubler, 1990). The tests showed that the participants reported an increase in well-being after eight weeks of vitamin supplementation, yet showed no increase in memory performance. In turn, mood was improved only in those participants lacking vitamins at the beginning of the study (Heseker & Kubler, 1990).

Learning and Memory

Learning can be defined as the gaining of knowledge, understanding or skill as a result of study or experience (Mish & Morse, 1994). In order for an individual to learn, information must be encoded into long- term memory (Squire et al., 1992). The nature of the learning material and the difficulty of the manipulations to be remembered may influence the type of processing that is required for long- term memory (Squire et al., 1992). Likewise, it has been found that a high level of motivation leads to better recall than a minimal effort and motivation (Tyler at al., 1979). It would seem that an unmotivated learner would not be willing to exert a high level of effort in an attempt to learn something. In addition to motivational issues, the depth of comprehension is likely a function of the complexity of the meaning components in a sentence. For example, Stevenson (1981) found that people were more likely to remember the target word “thin” when the word was embedded in a sentence such as, “The thin man looked at the picture of the fat woman,” rather than when embedded in a sentence such as, “The thin man looked at the picture of the woman in a dress.” Stevenson hypothesized that more meaningful elements were likely produced in the first sentence in order to remember the target word. In turn, it is more likely that a sentence will be remembered if it is deeply comprehended (Stevenson, 1981, Durso & Johnson, 1980).

Dismembering Information During Learning. When an individual receives an input, this information is sometimes thought of as being dismembered, or pulled apart into individual components, in order to be remembered (Telfer & Biggs, 1988). After an input is received, there are four ways in which this information may be dismembered, or encoded. The most common dimension, as mentioned previously, is with semantic encoding. With semantic encoding, word meanings are encoded as either verbal or auditory. Temporal encoding is another way of dismembering information in order to learn. Temporal encoding refers to the remembering of items in the order in which they are presented to the individual and then processed by the brain. For example, if an individual chooses to remember what they did in the afternoon, they might mentally walk themselves through the events of the day preceding the afternoon. Some information may also be encoded in a visuo spatial form. A map, or a diagram, for example, might help one to remember how objects are located in space. This is one reason why visual images may help some people to learn (Searleman & Hermann, 1994). Finally, a logical coding sequence tends to help individuals remember information better. Material that is not consistent, or is structured poorly tends to make the learning process significantly more difficult (Telfer & Biggs, 1988).

It's important to note that the four mentioned dismembering techniques might not be exclusive of one another. In fact, it is likely that different individuals use different coding techniques in order to learn (Martin & Clore, 2001). Likewise, a variety of the techniques may be used in combination with one another in order to remember the most information. This may be why many instructors try to use a variety of teaching

techniques, (verbal, visual, manual, etc.) to aid in student learning (Squire et al., 1992; Krahenbuhl et al., 1981 D.O.T., 1977).

Mood and Learning. Because learning involves the process of memory, the previous discussion of mood and memory may also apply to mood and learning. Several other factors, which may relate to mood state and learning, also deserve a brief discussion. For both students and pilots, problem solving and critical thinking skills are important concepts (U.S.D.O.T. 1999). There are situations within the classroom and in daily life that require an individual to correlate learned knowledge with problem- solving strategies (Dobson & Dobson, 1981). When in a negative mind state, however, studies have demonstrated that college students have a deficit in their ability to problem solve (Dobson & Dobson, 1981). This could lead to a decrement in classroom performance for tests that require students to use problem-solving strategies (Dobson & Dobson, 1981). Likewise, distractions seem to be an inevitable part of many learning environments (Seta et al., 1994). Outside noise, fans, noisy projectors and other students may all be sources of distractions while learning. Seta et al. (1994) demonstrated that individuals in a negative mood state were not as vulnerable to the influence of distractions on stimulus encoding in comparison to those in positive moods. This may be due to the idea that depressed individuals are devoting a larger amount of their attention to the mood state in comparison to those who are in a positive frame of mind (Ellis & Ashbrook, 1988; Hasher & Zacks, 1979).

Test Anxiety. There are several methods of testing a student's ability to retain information in long- term memory (Telfer & Biggs, 1988). Some of the methods may include an essay test, an objective test, a short answer test, or an oral test. An essay is a

continuous piece of prose written in response to a question or problem. It usually demonstrates the way in which students are able to organize their thoughts and express themselves clearly. Essay tests, however, are not always reliable, as instructor biases, fatigue at the time of grading, and the order in which tests are graded can cause unreliable results. Objective tests, on the other hand, are tests that are said to be “objective” in nature. The word “objective” may be defined as dealing with facts without distortion by personal feelings or prejudices (Mish & Morse, 1994). An example of an objective test may be a test that is graded by a computer. True or false tests and multiple-choice tests are examples of objective tests. Short answer tests are somewhere in between the essay and objective test. The format is useful in finding factual, straightforward answers. Finally, oral tests may be used in order to evaluate the student’s knowledge of a particular subject area. In aviation, oral ground tests are given before or after each major flight check ride. Likewise, all students are required to pass an objective aviation test, which covers most of the required aviation ground knowledge (U.S. D.O.T. 2002). Essay tests and short answer tests are also used in ground schools as ways of testing student pilot knowledge on various aviation subjects (Telfer & Biggs, 1988).

Because all people are different, each individual will likely experience a different level of anxiety when being tested. Some students may be poor writers, (spelling or penmanship) while others have difficulty expressing themselves verbally. While one individual may prefer a short answer test, the other may prefer an objective test. Likewise, tests have shown that individuals with high anxiety during testing situations are likely to have a difficult time processing semantic content, while individuals who do not become anxious during testing situations are likely to process information more

consistently (Mueller, 1978; Telfer & Biggs, 1988). This might be a pertinent consideration when assigning student tasks during an experiment or study. If the students perceive the study as being a “test,” some may feel anxious or threatened. This anxiousness can be perceived as one indication of a negative mood state that can influence memory performance. Although it might be impossible to keep students feeling completely at ease, it would appear that it may be helpful to assure students that they are not specifically being “graded or tested.” If students think of themselves as a “participant in a study,” it may help to reduce some of the test anxiety, which has been shown to cause problems with memory processing (Mueller, 1978; Telfer & Biggs, 1988).

Student Pilot Learning

Young individuals who make the choice to begin flight training may initially be surprised at the immense work load required to receive a private pilot’s license. Although some may perceive flight training as a simple task involving the mere learning of how to take off and land, the FAA guidelines outline detailed and thorough criteria (U.S. D.O.T. 2002). The initial realization of the multitude of information one must learn during the course of earning a private pilot license may cause some students to drop out of the training program. At Embry Riddle Aeronautical University (ERAU), approximately 50% of all beginning freshman student pilots drop out of the private pilot training program and leave the university or change to other degree programs (personal communication, Borgins, L. August, 2002.) One of the causes of this high drop out rate may be attributed to the difficulty students experience during the learning process of ground-based material.

Pilot Standards. Before an individual is even allowed to obtain a student pilot certificate, they must pass a thorough medical examination. This “pilot physical” must be performed by a designated FAA medical examiner who uses the required medical diagnostic equipment specific to aviation (U.S. D.O.T. 2002.) There are three types of pilot medical certificates that an individual may receive. The “first class” airman medical certificate is the most thorough of all the pilot medical examinations. This is required for all airline transport pilots, and includes a detailed eye exam, and an electrocardiographic examination after age 35, and each year after the age of 40. Vision must be normal, with a distant visual acuity of 20/20 or better, and a near vision acuity of 20/40 or better. In addition, applicants are tested for colorblindness, color deficiencies, and any possible auditory problems. Applicants for the first class medical must demonstrate the ability to hear an average conversational voice, with both ears, in a quiet room at a distance of six feet from the examiner, with their back turned. The applicant must also have a clear understanding of speech, and be able to communicate effectively. Mentally, the applicant must not have a psychosis, a substance dependence (other than tobacco or caffeine) a bipolar or personality disorder, or any other medical condition which may cause the person to be unable to safely perform the duties or privileges of the airman certificate.

The lower levels of medical certification include the “second” and “third class” airman medical certificates. The second-class certificate is required for all commercial pilots, while the third class certificate is the minimum required for any individual who wishes to obtain a flight rating. Both are similar to the first class medical certification in terms of mental, neurological and auditory requirements. Visual acuity for the second-class certificate requires 20/20, or better, in both eyes for distant vision and 20/40, or

better, for near vision. The vision test for the third class certificate, however, requires distant and near visual acuity of only 20/40 in each eye. The main difference in the medical examinations occur when applicants are over the age of 40. The cardiovascular examinations, for example, are more stringent for the first class applicants in comparison to the second and third class applicants. In order to be a student pilot, the student must obtain either a first, second or third class airman medical certificate. Although the third class medical certificate is the minimum medical certificate required for a student pilot, all three types are acceptable (U.S. D.O.T. 2002).

Student Pilot Requirements. There are several ways in which an individual can apply for a student pilot certificate. One common way is to apply through the aviation medical examiner. In this case, the first medical certificate a student receives will be combined with the student pilot certificate. Thus, it is categorized as a “medical/ student pilot” certificate. The alternate way is to apply to the Flight Standards District Office (U.S. D.O.T. 2002). In this circumstance, the student may have a separate medical and student pilot certificate. In either case, the applicant must have passed the previously discussed psychiatric and physical medical examinations. This should mean that the student has no diagnosed depression or mental disorders. Furthermore, the student pilot should be able to hear a verbal presentation clearly, and view a written presentation without difficulty.

In addition to the medical requirements, student pilots must be at least 16 years of age or older. The student must also be able to read, speak, write and understand the English language (U.S. D.O.T. 2002). This means that a lecture that is presented to a

student in English, should be able to be read and understood. Likewise, the student should be able to respond to the lecture with verbal or written English.

Ground School. Once an individual has received a student pilot/ medical certificate, they will likely begin looking for places in which to begin a flight-training program. Flight training programs may vary widely from flight school to flight school, both in the type of aircraft flown, and in the manner in which aeronautical concepts are explained (U.S. D.O.T., 1997). Large colleges, such as Embry Riddle Aeronautical University (ERAU), are normally under part 141 of the *Federal Aviation Regulations* (2002). Under a part 141 flight-training program, aviation schools are required to meet numerous specific requirements regarding the amount of hours and type of training required in order to receive a flight rating (U.S. D.O.T., 2002). For the private pilot airplane course, a minimum of 35 hours of ground training must be completed in order to cover the required aeronautical knowledge curriculum. Ground training must include such topics as pre-flight actions, aeronautical decision-making, aerodynamics, aircraft systems, aircraft performance, radio communication procedures, aeronautical charts, the accident reporting system, and all applicable *Federal Aviation Regulations* (U.S. D.O.T., 2002). This list demonstrates the importance of classroom learning during student pilot training. The student is not simply stepping into the airplane and learning how to fly. The student is required to complete a minimum of 35 hours of ground instruction in addition to the required airplane flight training. If student pilots are not able to learn effectively and efficiently in the classroom environment, the success of the overall flight training program will likely be hindered.

Most studies that examine the performance of student pilots seem to focus on specific aspects of flight training, such as spatial orientation and flight adaptation (Hanley, 1985; Tessonneau, 1973). However, emotions and effective learning are also linked with safety in the sky (e.g. students should be concentrating on the flight maneuver rather than daydreaming about something else.) Studies on ground learning and emotion, however, are much less prevalent. If ground-based instruction is such a large requirement for the private pilot license, it would be appropriate to expect knowledge to be significant and directly linked with safety. For example, a student who is mentally distracted during a lesson on the stall/ spin recovery procedure may not be able to retain the knowledge of how to maneuver the aircraft in case this event were to actually occur. In addition, the stall/ spin recovery procedure is not taught or demonstrated during the actual in-flight training, due to the fact that a spin entry can be dangerous and cause damage to the aircraft. A student may never have been shown how to perform or recover from a spin in the aircraft until he or she is working on the Certified Flight Instructor (CFI) course. Student pilots, however, are given a logbook endorsement to practice solo flights with the understanding that stall/ spin recovery procedures have been discussed in an oral ground lesson (U.S. D.O.T., 2002). This is an example of a situation in which student retention of ground based instruction is extremely important. If the student departs on a solo flight and accidentally ends up in a stall/ spin situation, there is no CFI on board to recover the aircraft from the very dangerous flight attitude. The stall/ spin recovery technique was likely taught, however, the student may not have retained the knowledge necessary to correct the problem. This could lead to catastrophic

consequences for the student, and is largely due to retention problems during the ground instruction. (U.S. D.O.T., 1997).

Pilot Learning and Emotion. Student pilots are all unique individuals, and each likely learns in a different way. There are several common beliefs, however, which describe some general theories relating to pilot learning (U.S. D.O.T., 1999). The *Aviation Instructor's Handbook* refers to the first principal of learning as the "Law of Readiness." The "Law of Readiness" pertains to the idea that student pilots will not learn effectively unless they are ready and eager to acquire new information (U.S. D.O.T., 1999). From the previous discussion on mood and learning, it seems likely that students will not be ready and eager to acquire new information if their minds are preoccupied with negative feelings. The *Aviation Instructor's Handbook* emphasizes that there may be very little a flight instructor can do in order to inspire the student to learn if the student is not ready, willing and interested in obtaining new knowledge (U.S. D.O.T., 1999). Another mood- related concept mentioned in the *Aviation Instructors Handbook* is the "Law of Effect", (U.S. D.O.T., 1999) which states that the emotional reaction of the learner is very important to the strengthening of knowledge. Learning will be strengthened when accompanied by pleasant and satisfying feelings, and weakened when accompanied by unpleasant feelings.

In the discussion of pilot learning, it may also be important to note the effects of primacy and recency. Primacy, or the state of being first, has been shown to create a stronger, more easily remembered impression in the minds of learners (Searleman & Hermann, 1994). This theory suggests that whichever item is presented first in a lesson might be more easily remembered by the student. Likewise, the idea of recency concerns

the idea that items which are most recently learned are going to be remembered better than those items presented in the middle of a long lecture (U.S. D.O.T. 1999). One would expect a student to recall the last items learned more readily than other items. Combining the two ideas, a student pilot is likely to have a better memory for the first and last ideas presented in a lecture, rather than the material that is presented in the middle of the lecture. In addition, important concepts may need to be repeated at the beginning and end of a lesson in order to increase the likelihood of student comprehension.

There are numerous reasons why a student pilot may forget important aviation concepts (Cockle & Moore, 1999; Krahenbuhl et al., 1981; Picano & Edwards, 1996; Tessonneau, 1973). Motivation seems to play a large role in the success of a student's flight training (Cockle & Moore, 1999). Without a high level of motivation, students will not likely have the desire to retain important aviation concepts. An example of an unmotivated flight student might be one whose father or mother has forced him/her to take flying lessons. Although the student may not have the self-ambition to gain flight knowledge, he goes through the steps of flight training in order to satisfy the wishes of his parents. This student will not likely be a motivated classroom learner, as he would probably rather be doing something else. Although motivation could possibly be an issue in a college flight program, it would seem that the time commitment and expense of attending college would discourage a good number of un-motivated students from attending. It therefore, should be assumed that the majority of students who attend an aviation college, (such as Embry Riddle Aeronautical University) in general demonstrate enthusiasm and motivation to learn about aviation and aviation related concepts.

Impaired concentration due to a negative mood state, however, could cause a normally motivated flight student to become temporarily unmotivated (Cockle & Moore, 1999).

Another aviation learning theory is similar to the mood-memory literature, which was discussed earlier. This theory states that interference can cause a great deal of trouble when attempting to remember an aviation concept (U.S. D.O.T., 1999). This implies that students tend to forget a concept or idea when a certain experience has overshadowed it. It would seem that materials, which have not been highly learned, may suffer from interference the most (Weingartner et al., 1981; Ellis et al., 1984). Therefore, a negative mood can be perceived to be an interfering variable in the student pilot's ability to learn new information. A study conducted by Picano and Edwards (1996) investigated psychiatric syndromes associated with problems in aeronautical adaptation among military student pilots. In addition to anxiety, marital conflicts, and misconduct, depression was said to have been the cause of student pilot failure in 13% of the 99 cases studied. The study concluded that it is important to identify specific emotions early on, in order to help assist in the process of aeronautical learning and adaptation (Picano & Edwards, 1996). In order to test for the effect of emotion on learning, one must induce a specific mood state in the learners. The process for inducing mood states will be discussed in the following section.

Mood Induction

In order to study the relationship between mood and memory, one must devise a way of leading experimental participants to be induced into a particular mood state. Problems in mood and memory testing have occurred when individuals were not

successfully induced into the proper mood state prior to testing (Hasher et al., 1985; Ellis, 1985). Although researchers in the past have manipulated mood through various techniques such as hypnosis, (Bower, 1981) the most extensively used technique has been the Velten Mood Induction Procedure (Finegan & Seligman, 1995; Goodwin & Williams, 1982; Jennings et al., 2000; Wetzler, 1985;). Any research involving mood induction procedures must be analyzed at two levels. The first level is needed in order to determine the success of the mood induction procedure. It is important for the researchers to determine that the proper mood induction has been accomplished prior to moving on to the second level (Ellis, 1990). This means that the researcher must state an acceptable criterion for successful mood induction before the experiment begins. The second stage includes proceeding to the study, in which the variables of interest must be defined and measurable (Kenealy, 1986).

Velten Mood Induction. The first set of mood induction statements was created by Velten (1968). For this study, one hundred female college student participants were divided into three groups. One group read positive statements, the second read negative statements, and the third group read neutral statements. For each of the conditions, participants were told to try to experience the mood presented to them (positive or negative). Examples of elated statements included, “My attitude is good!” or “This is great, I really do feel good.” Examples of depressed statements included, “Every now and then I feel so I tired and gloomy that I would rather just sit than do anything” or “I have too many bad things in my life.” Examples of neutral statements included, “Utah is the Beehive State” or “Mules hauled the supplies up the mountain.” Findings from Velten’s study demonstrated that the procedure had, in fact, caused an induced state of

elation or depression in the participants (1968). Studies by Gerrards-Hesse, Spies & Hesse (1994) and Westermann, Spies, Stahl & Hesse (1996) however, both reported that the Velten technique was only highly effective for inducing depression, but not for inducing elation. Many other successful mood induction studies have been performed which include male participants and varied numbers of mood induction statements (Jennings et al. 2000; Kwiatkowski & Perkinson, 1994; Wagata & Trierweiler, 1988) A study by Seibert and Ellis (1991) reported that the overall decrease in the number of statements, as well as in the reduction in test duration, did not influence the effectiveness of the mood induction. This indicates that it is not necessary to use a large number of statements or require a lengthy examination period in order to induce a temporary mood state.

Duration of the Velten Mood Procedure. When experimentally inducing negative moods in individuals, it is important to consider how long the negative mood will last, and how the participant will feel when the experiment is over. Investigations by Frost and Green (1982) attempted to answer these questions. Two main concerns relevant to their study were; (1) Do subjects leaving a Velten Mood Induction procedure study continue to stay in a negative mood? Moreover (2) Do the effects of the Velten Mood Induction Procedure last long enough for the investigators to rely on the elicited moods? Results of the study demonstrated that those participants who were given a negative induction continued to feel the effects of the induction after 10 minutes. The positive feelings, however, were considerably weaker. Subjects put into the elation condition did not feel any more elated after 10 minutes than did the neutral subjects (Frost & Green,

1982). This may be another reason why the elation procedure has been unreliable in past studies.

Ethical Issues. Because the effects of a negatively induced mood tend to remain after a ten-minute period, it is important that the experimenter take steps to remove the negative mood state before the participant leaves the test site. The study by Frost and Green (1982) demonstrated that this can be effectively done by using a series of elation statements after the tests have been completed. Other studies have also used this technique in order to ensure that participants did not leave the experiment in a depressed mood (Ellis, Thomas, & Rodriguez, 1984).

Velten Statements. A variety of Velten mood induction statements have been used in order to induce various mood states. One study attempted to rate the effectiveness of mood enhancing sentences (Jennings et al., 2000). In this test, participants used a Self Assessment Manikin (SAM) test in order to rate the arousal and valence produced by 84 positive, neutral, and negative statements. Likewise, gender differences in valence and arousal ratings were examined in order to determine if males or females would rate the verbal statements as more arousing, more positive, or more negative. Results demonstrated that fifty-two of the statements were consistent with Velten's valence designations. The other statements yielded valence means that were inconsistent with Velten's Designation as determined by the SAM cutoff criteria. This indicates that when using the Velten Mood Induction technique, the sentences that were shown to produce large changes in mood would likely demonstrate promising results. Those statements that failed to meet the SAM rating's cut off criteria however, may not reliably reflect the outcomes expected during mood induction (Jennings et al., 2000).

In developing the mood induction statements, the positive and negative statements have generally referred to oneself, such as “I feel lousy.” Conversely, the neutral statements, did not relate to the individual, and usually lacked relevance to mood. “Diamonds really can cut glass,” is an example of this type of neutral statement (Jennings et al., 2000). For the Jennings et al. (2000) experiments, males and females rated valence and arousal for the positive and negative statements similarly, although males rated the low arousal statements as more arousing than did the females.

Group Mood Induction. A technique, which is thought to save time when using the Velten Mood Induction procedure, involves group mood inductions. When there is a large sample of participants, or if a large factorial design is implemented, collecting data from groups may be desirable in terms of efficiency. It is argued, however, that group mood induction procedures may threaten the validity of the findings and increase Type 1 error. Likewise, by manipulating only one mood in a particular group setting, there might be a possibility of experimenter bias or local history effects (e.g. the experimenter reads statements to each group with a varying tone in their voice) (Sinclair et al., 1994). Administering the mood manipulations to each participant individually via a written statement should avoid such problems. By reading each statement to himself or herself, the participants will be able to feel the mood state without experimenter confounds.

Screening for Depression: Ethics of Mood Induction

Ethically, it is critical that a researcher does not induce an already depressed individual into a further state of depression during an experiment (Kenealy, 1986). For this reason, it is important that proper screening measures be taken before the mood

induction process begins, in order to ensure that subjects are in a healthy mental state.

One popular means to screen for depression before a testing includes the use of the Beck Depression Inventory (1967). This inventory includes 21 items. Each item in the inventory is made up of a group of four statements that describe a range of feelings. Numerical values (0, 1, 2, or 3) are then assigned to the feeling description statements within the group. Higher values represent more depressed feelings, such as, "I am so sad or unhappy that I can't stand it," while lower numbers represent non-depressed feelings such as, "I do not feel sad." These statements are written next to the numbers in order for individuals to remember which feeling relates to which number. Participants are asked to select the statement that most accurately describes their current mood state. This technique has been found to be successful in estimating the psychiatric condition of healthy college students (Bumberry, Oliver & McClure, 1978; Ellis et al., 1984; Hammen & Padesky, 1977; Kwiatkowski & Perkinson, 1994). In a mood induction study performed by Ellis (1984), participants were excused if their total Beck Depression Inventory score was 20 or higher. This was a cautionary measure for the protection of those individuals who were already showing depressed qualities.

Assessing Mood Induction

How can the success of mood induction be measured? It would seem important that an experimenter be able to tell if the mood induction was, in fact, effective. If a mood induction procedure is given, and the experimenter simply moves on with the test, how can one ensure that the participants are really in the desired mood state? In order to measure the success of mood induction, a checklist is needed in order to demonstrate the degree to which the mood procedure has manipulated each participant. The Multiple

Affect Adjective Checklist (MAACL) is one form of assessing the effectiveness of the mood induction procedure (Zuckerman & Lubin, 1965). The checklist is composed of 132 adjectives, which describe various mood states. Individuals are told to choose words from the list that describe how they are feeling at that moment. It has been shown to take about 3 minutes in order to complete the MAACL (Nagata & Trierweiler, 1988). Ellis and colleagues (1984) used a different variation instrument, the Depression Adjective Checklist (DACL). The DACL includes 21 negative- mood adjectives and 11 positive- mood adjectives. Ellis (1994) totaled the negative words checked and the positive words not checked in order to produce a score. High scores indicated a depressed-mood state, while low scores were indicative of a more positive mood state (Leigh & Ellis, 1981; Ellis et al, 1994). The mean score on the DACL was 20.8 for participants given the depressed mood induction, and 7.8 for participants in the neutral mood condition (Leigh & Ellis, 1981).

The Present Study

The purpose of the present study was to examine the relationship between an induced negative mood state and the ability of a student pilot to remember complex aviation material. Although numerous studies have demonstrated a relationship between mood and memory, (Asuncion & Lam, 1995; Clark, Milberg & Ross, 1983; Ellis, Thomas & Rodriguez, 1984; Hertel & Hardin, 1990; Leight & Ellis, 1981; Parrott & Sabini, 1990) the literature is void of relevant studies of this type relevant to student pilot learning. It would seem, however, that the results obtained from the Ellis et al. (1984) study (see page 9 for details of the Ellis et al., 1984 study) would be similar to those expected in the present study, based on the theories of pilot learning (U.S. D.O.T. 1999).

The two questions being examined in this study are as follows:

- 1- How will an induced negative mood state affect a student pilot's ability to retain complex aviation material?
- 2- Will there be a difference in the student pilot's ability to remember base, aviation related sentences in comparison to elaborated, aviation related sentences?

Based on previous research, it is believed that the Velten Mood Induction technique will be able to produce a temporary negative mood state in healthy college students (Jennings, 2000; Finegan & Seligman, 1995; Frost & Green, 1982). Likewise, a test, which is similar to that of Ellis and his colleagues (1984), is expected to produce comparable results. In turn, the study will include the use of both base sentences and elaborated sentences that pertain to aviation concepts. The base sentences will be shorter sentences that include a key word (the participants will not know what the key word is while reading the sentence.) The elaborated sentences will include the base sentence, the same key word, and an additional phrase intended to assist the student in memory retention. It is anticipated that those participants in the negative mood state will remember less of the key words in both the simple and elaborative sentences. Furthermore, it is anticipated that both groups will remember more of the key words in the elaborative sentences, but that the participants in the neutral mood state will remember a significantly greater number. The aviation concepts in the sentences will include complex aircraft performance, complex aircraft operations, and complex aircraft systems; all topics which beginning student pilots have not likely been exposed. This will ensure that there is not a learning bias between those students who are already familiar with the aviation concepts, and those who are not.

Method

Participants

Forty student volunteers from private pilot ground courses at Embry Riddle Aeronautical University in Daytona Beach, Florida served as experimental participants. Students were told that they were volunteering to assist in a mood- related learning experiment. Volunteers were offered small amounts of class credit as an incentive to participate in the study. All volunteers were student pilots who held either a first, second, or third class airman's medical certificate. Twenty-eight male student pilots and 12 female student pilots participated in the test. The student pilot volunteers ranged in age from 18 to 27 years old. All were unmarried, full time college students.

Materials and Apparatus

The entirety of the test was performed in an average college classroom, containing 85 seats that were spaced approximately 20 inches apart from one another. The work stations were spread out across the room with the hope of discouraging student interaction. The room was air conditioned and well lit, in order to provide a comfortable environment for learning. A PowerPoint presentation was used to issue most of the instructions for each task. The Power Point presentation was projected on a large screen in order to increase the noticeability and readability of the instructions. Written instructions were used in order to prevent confounds from experimenter error while issuing the instructions. Each of the written tests and surveys were printed on standard white paper, and passed out individually to the participants.

The mood induction statements were typed on 3 x 5, white index cards. The cards contained a set of 40 neutral, or 40 negative statements, which intended to produce a neutral or negative mood state in the students (see appendix E). The cards with the negative statements were ordered so that the content of the statements became progressively more emotional, as recommended by Ellis et al. (1984). The cards were also handed out individually to each subject, in order to prevent participants from viewing the statement cards of fellow classmates.

Twenty aviation-based sentences were produced for the teaching lesson. All sentences contained statements about advanced aviation concepts (see appendix F). Ten of the sentences were simple, base sentences. These sentences were formatted to be similar to those used in the Ellis et al. study, (1984) but were related to advanced aviation concepts. An example of a base sentence might be, "Wing mounted vortex generators reduce the drag caused by supersonic airflow." After reading all sentences, the student was later presented with the same sentence, and the word "Wing" missing. The student was then required to guess the word "Wing" in place of the blank line. The remaining 10 sentences were elaborated sentences. The elaborated items included each base sentence, plus a phrase that served to make the target word more distinctive. An example of the elaborated sentence would be, "Wing mounted vortex generators reduce the drag caused by supersonic airflow over the portion of the wing." In this sentence, the word "Wing" was thought to be easier for the student to remember, because the elaborated sentence included the word "wing" at the end of the sentence.

Screening Procedure

Before initiating the mood induction procedure, participants were asked to complete a Beck Depression Inventory (1967) in order to test for signs of pre-test depression (see appendix D). The Beck Depression Inventory is composed of 21 questions, each related to emotional state. After each question, a group of four statements follow. These four statements describe a range of feelings that are combined with numerical values. Higher numerical values (2, 2, 3) represent more depressed feelings, such as, “I am so sad or unhappy that I can’t stand it,” while lower numbers (0, 1) represent non-depressed feelings such as, “I do not feel sad.” Instructions for completing the inventory were displayed on the screen in front of the classroom via the Power Point presentation. Following the completion of the Beck Inventory, the forms were examined and the scores of the inventory were totaled. Participants receiving a score higher than 20 were excused from the study. This ensured that students were not depressed at the onset of the study.

Mood Induction and Assessment

Student pilots were induced into a negative mood state or left in a neutral mood state with the use of the Velten Mood Induction procedure (1968). For this procedure, students read a series of 40 cards at regular 15-second intervals (as prompted by an audible beeping noise). One group of students read cards with negative self-statements, while the other group read cards with neutral statements. After reading through all 40 cards, a Depression Adjective Checklist (DACL) was handed out to each student. The checklist was used in order to ensure that each student was induced into the expected

mood state before the learning procedure began. Before reading the statements, all students were informed that the sentences might affect their mood. They were also told that they were free to terminate their participation in the experiment at any time if they wished.

Design and Analysis

The current experiment was set up as a 2 x 2, fully factorial, mixed design. The first set of conditions involved either a student pilot experiencing an induced negative mood state, or a student pilot who was in a neutral mood state. The second set of conditions involved a series of two types of sentences. The first 10 sentences served as base sentences from which the student pilot was required to remember a missing word. The second set of sentences included the base sentence, but was elaborated, in order to give a better indication of the missing word. All participants read the same sentences and completed the same memory tests. This allowed the two hypotheses to be tested. The mood-induction cards were handed out to each student faced down after being shuffled. This attempted to ensure that the design was randomized in selecting individuals for the neutral or negative mood condition. The independent variables in the experiment included the base and elaborated sentences, as well as the various mood state. The dependent variables included the memory abilities and resulting scores of the participants in the neutral and negative mood states.

A preliminary power analysis was performed prior to initiating the study by using the results obtained from the Ellis, et al., (1984) data. The power analysis indicated that a power value of 0.93 was achieved with the use of 40 participants when sentences were

shown for 10-second intervals. The 0.93 value was achieved when alpha was set at .05. In addition, all possible pair wise comparisons were made. Although a power value of .80 is normally suggested for statistical data collection, it was decided that a higher power value and a slightly larger sample size would strengthen the experiment. Although the Ellis, et al. (1984) study was conceptually the same as the current experiment, the two tests were methodologically different. This was due to the fact that the current study used aviation- based sentences, rather than typical, “every day” sentences as used by Ellis and colleagues (1984).

Procedure

Student pilots were informed of the chance to participate in this study approximately one week prior to the initiation of the testing (see appendix A). Students were presented with the opportunity to enroll in the study during their private pilot ground school course at Embry Riddle Aeronautical University. On the enrollment form, students were given the opportunity to provide an Electronic mail (E-mail) address. One day prior to the initiation of testing, all students received an E-mail reminding them of the study, and encouraging them to obtain a regular night’s sleep. Verbal and written reminders were also issued by the professors teaching the various classes.

Upon arriving at the testing site, participants were given a consent form to sign (see appendix B.) The form reminded students that they were free to leave the test at any time if they felt uncomfortable. Moreover, the consent form contained a reminder that the individual would not have their name related to any of the findings in the study. After signing the consent form, students were individually given a form to complete which

contained questions concerning personal information such as age, gender, flight level, medical certification and knowledge of complex aircraft performance and operations (see appendix C). The personal survey was combined with a designated number that the student pilots were told to write on the top of each paper (for tracking purposes). This survey was then completed and handed back to the experimenter. Next, students were given a Beck Depression Inventory to complete (see appendix D). Those participants who received a 20 or higher would have been excused from participation in the experiment.

Next, Velten Mood induction cards were individually handed out to each participant, faced down (see appendix E.) Students were instructed to read the top card several times until hearing a bell ring. At 15 second intervals, the bell would ring, prompting the students to switch to the next card. After 10 minutes, all mood statement cards had been read by the students. At this point, the DACL was handed out. Students completed the checklists, and each paper was collected. This took approximately three minutes. After this, the teaching session began. Students were instructed to read each sentence on complex aircraft, and were advised to refrain from taking notes (see appendix F.) A mixture of ten base sentences and ten elaborated sentences were presented individually and randomly on the overhead screen for a period of 10 seconds each.

After the teaching session, students were instructed to complete a series of simple math problems (addition and multiplication) for a duration of one minute. This was to ensure that the students were not rehearsing the previously viewed sentences. After completing the math problems, students were given the final test in which the target word was missing. Participants were told that they would see each of the previously

viewed sentences again, but that each sentence would contain a blank line in which a target word had been left out. They were also told that they may use the same word more than once, and that guessing was encouraged. Each sentence was then displayed for 10 seconds, but the order in which the sentences were presented was mixed up. The participants were asked to recall and record the missing word.

Post Testing

After all tests were completed, each participant was given 10 note cards that contained positive Velten Mood Induction statements (see appendix E). These cards were again read at 15-second intervals via the prompting of an audible beep. Before leaving the test site, an abbreviated version of the Beck Depression Inventory was completed by each student pilot. The experimenter checked to ensure that each participant did not depart the testing environment in a depressed mood state. Participants were then thanked and dismissed.

Results

Data

The data from the dependent variable (Score) was collected for the forty participants. This data was divided between the levels of the independent variable (Mood or Sentence Type,) and the data was summarized (see Table 1). Results were tested for significance and effect size using a repeated measures analysis of variance (see Table 2).

Target Word Recall

The results indicated that the subjects in the negative mood state recalled fewer target words than the subjects in the neutral mood state, $F(1, 38) = 23.45$, $p < .001$, eta squared = .38. There was not, however, a significant interaction between the recollection of words in the base vs. elaborative sentences, $F(1, 38) = 2.31$, $p = .137$, eta squared = .057. Likewise, there was no significant interaction between mood and sentence type, $F(1, 38) = .046$, $p = .681$, eta squared = .005.

Mood-Induction Procedure

The success of the Velten Mood Induction procedure was confirmed with the scores of the DACL. The participants in the neutral mood state had an average score of 5.85 on the DACL, while the participants in the negative mood state had an average score of 11.2. This difference was shown to be significant, $F(1,38) = 27.401$, $p < .001$.

Beck Screening

The average Beck Inventory (1967) scores for both groups of participants was 5.0 upon initial testing. This indicates that there were no real differences between the mood-states of each group upon beginning the study. All participants received a score lower than 20 on the initial Beck Inventory (1967); therefore, none of the participants were excluded from the study because of high scores.

Table 1.

Descriptive Statistics

Mood	Sentence Type	N	Mean	Std. Deviation
Neutral	Base	20	6.05	1.57
	Elaborative	20	6.40	1.85
	Total	40	6.22	1.70
Negative	Base	20	3.90	1.29
	Elaborative	20	4.10	1.48
	Total	40	4.00	1.38

Table 2.

Analysis of Variance of Mood vs. Sentence Type on Recall

	Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Mood	99.01	(1,38)	99.01	23.45	.00
Sentence Type	1.51	(1,38)	1.51	2.31	.14
Mood*Type	.11	(1,38)	.11	.17	.68

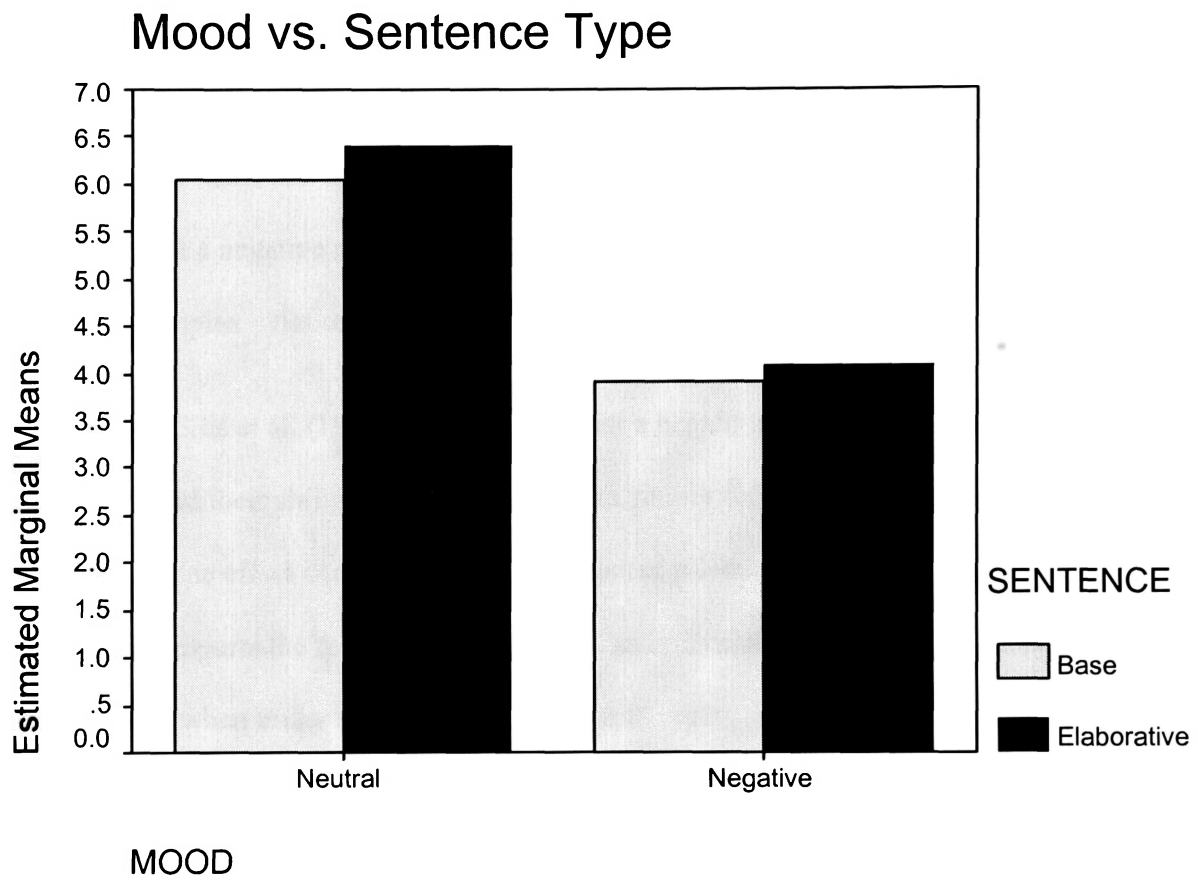


Figure 1. Graph showing recall of target words from elaborated and base sentence types.

Discussion

The results of the data indicate that a negative mood state had a considerably significant effect on the student pilot's ability to remember complex aviation sentences. This was shown by the significant difference in correct answers produced by the students in the neutral and negative mood states. The average score of the student pilots in the negative mood was much lower than that of the student pilots in the neutral mood. These results indicate that a negative mood state likely does have an effect on a student pilot's ability to learn complex aviation material.

While the Ellis et al. (1984) study showed that a negative mood state affected college students and their ability to retain words from simple sentences, this study showed that the same effect occurred when using student pilots and complex aviation sentences. This supports the theory that the mind of an individual will likely not retain as much information when under the burden of negative thoughts. This study indicates that the theory may hold true for a variety of learning situations. Student pilots seem to be affected by a negative mood state in much the same way that a typical college student is affected by a negative mood state. Both groups have been shown to have trouble retaining information.

In comparing base and elaborated aviation sentences, however, there does not seem to be a significant effect. Students seemed to remember the missing target word in the aviation sentences similarly with both the base and elaborated sentence structures. This may be due to the fact that the study was performed using complex, technical sentences, rather than sentences based on simple concepts. While the Ellis et al. (1984)

study showed that there was a difference in a student's ability to remember a target word in a base versus elaborated sentence, the sentences he was using were based on general knowledge (opening doors, etc.) Likewise, the elaborated sentences may have helped to produce a visual image in the mind of the student in order to help with memory retention. In this study, technical aviation concepts were used. Due to the highly technical content of the material, the elaborated sentences did not likely help to produce a visual picture in the mind of the student pilot. It may be that complex aviation material must be remembered for its conceptual ideas, rather than remembered by a simple elaboration of the sentence. This point would need to be examined with further research and testing.

Although the FAA warns flight instructors about teaching a student pilot who is not in a positive mood state for learning, the idea has never been tested in the past. The present research helps to support the idea that a negative mood state will likely hinder a student pilot's ability to learn the ground-based material required to become a private pilot. This research may be helpful to aviation ground instructors and certified flight instructors who wish to explain the importance of a positive mental state to their students. If both students and instructors understand the possible consequences of attempting to learn while in a negative mood state, steps may be taken to avoid this situation. In turn, this may increase the productivity of the learning process substantially.

Conclusion

The findings from this study support the research that has been done in the past on negative mood and memory. Furthermore, the study supports the hypothesis that a negative mood state will cause a decrement in memory performance for student pilots who are attempting to remember ground-based material. Although further research needs to be done concerning base and elaborative aviation sentences, evidence has shown that a negative mood state will cause a lowering of over-all student pilot memory ability. In turn, the research has successfully fulfilled its intent to show a definite correlation between a negative mood state and student pilot, ground-based learning.

References

- Asuncion, A.G. & Lam, W.F. (1995). Affect and impression formation: Influence of mood on person memory. *Journal of Experimental Social Psychology*, 31, 437- 464.
- Beck, A.T., Ward, C.H., Mendelson, M., Mock, J. & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, 4, 53-63.
- Bower, G.H. (1987). Commentary on mood and memory. *Behaviour Research and Therapy*, 25 (6), 443-455.
- Bower, G.H. (1981). Mood and Memory. *American Psychologist*, 36, 129-148.
- Bumberry, W., Oliver, J.M. & McClure, J.N. (1978). Validation of the Beck Depression Inventory in a university population using psychiatric estimate as the criterion. *Journal of Consulting and Clinical Psychology*, 46 (1), 150-155.
- Christianson, S.A. (Ed.). (1992). *The Handbook of Emotion and Memory: Research and Theory*. Hillsdale: Lawrence Erlbaum Associates.
- Clark, M.S., Milberg, S., & Ross, J. (1985). Arousal cues arousal-related material in memory: Implications for understanding effects of mood on memory. *Journal of Verbal Learning and Verbal Behavior*, 22, 633-649.
- Cockle, S.L. & Moore, P.J. (1999). Predictors of pilot learning: Control beliefs and achievement goal orientations. *Engineering Psychology and Cognitive Ergonomics*, 3, 241-247.
- Deijen, J.B., Vander Beek, E.J., Orlebeke, J.F., & Vanden berg, H. (1992). Vitamin B-6 supplementation in elderly men: Effects of mood, memory, performance and mental effort. *Psychopharmacology*, 109, 489-496.
- Dobson, D.J. & Dobson, K.S. (1981). Problem-solving strategies in depressed and nondepressed college students. *Cognitive Therapy and Research*, 5 (3), 237- 249.
- Durso, F.T. & Johnson, M.K. (1980). The effects of orienting task on recognition, recall and modality confusion of pictures and words. *Journal of Verbal Learning and Verbal Behavior*, 19, 416-429.
- Ellis, H.C. (1985). On the Importance of mood intensity and encoding demands in memory: Commentary on Hasher, Rose, Zacks, Sanft and Doren. *Journal of Experimental Psychology: General*, 114 (3), 392-395.

- Ellis, H.C. (1989). The “state” of mood and memory research: A selective review. *Journal of Social Behavior and Personality*, 4 (2), 1-21.
- Ellis, H.C. (1990). Depressive deficits in memory: Processing initiative and resource allocation. *Journal of Experimental Psychology: General*, 119 (1), 60-62.
- Ellis, H.C. & Ashbrook, P.W. (1988). Resource allocation model of the effects of depressed mood states on memory. In K. Fiedler & J. Forgas (Eds.), *Affect, cognition and social behavior*, (pp.25-43). Toronto: Hogrefe.
- Ellis, H.C. & Hunt, R.R. (1989). *Fundamentals of Human Memory and Cognition* (4th ed.). Dubuque, IA: Wm, C, Brown Publishers.
- Ellis, H.C., Thomas, R.L., & Rodriguez, I.A. (1984). Emotional mood states and memory: Elaborative encoding, semantic processing and cognitive effort. *Journal of Experimental Psychology: Learning Memory and Cognition*, 10 (2), 181-197.
- Finegan, J.E. & Seligman, C. (1995). In defense of the Velten Mood Induction Procedure. *Canadian Journal of Behavioral Science*, 27 (4), 405-419.
- Fisk, A.D. & Schneider, W. (1984). Learning memory and cognition. *Journal of Experimental Psychology: General*, 10 (2), 181-197.
- Frost, R.O. & Green, M.L. (1982). Velten Mood Induction Procedure effects: Duration and postexperimental removal. *Personality and Social Psychology Bulletin*, 18 (1), 341-347.
- Gerrards-Hesse, A., Spies, K. & Hesse, F.W. (1994). Experimental induction of emotional states and their effectiveness: A review. *British Journal of Psychology*, 85, 55-78.
- Goodwin, A.M. & Williams, M.G. (1982). Mood induction research- Its implications for clinical depression. *Behaviour Research and Therapy*, 20 (4). 373-382.
- Guenther, R.K. (1988). Mood and memory. In G. M. Davies & D.M. Thomson (Eds.), *Memory in context: Context in memory* (pp.57-80). Chichester: John Wiley & Sons.
- Hammen, C.L. & Padesky, C.A. (1977). Sex differences in the expressive responses on the Beck Depression Inventory. *Journal of Abnormal Psychology*, 86 (6), 609- 614.
- Hanley, I. (1985). Student pilot stress: An emotional barrier to efficient flight training. *Third Symposium on Aviation Psychology*, 541-549.

- Hasher, L., & Zacks, R.T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General*, 108, 356-388.
- Hasher, L., Rose, K., Zacks, R.T., Sanft, H. & Doren, B. (1985). Mood, recall, and selectivity effects in normal college students. *Journal of Experimental Psychology: General*, 114 (3), 392-395.
- Hertel, P.T. & Hardin, T. S. (1990). Remembering with and without awareness in a depressed mood: Evidence of deficits in initiative. *Journal of Experimental Psychology: General*, 119 (1), 45-59.
- Hertel, P.T. (1992). Improving memory and mood through automatic and controlled procedures of mind. In D.J. Herrmann, H. Weingartner, A. Searleman & C.L. McEvoy (Eds.), *Memory improvement: Implications for memory theory* (pp.43-60). New York: Springer-Verlag
- Heseker, H. & Kubler, W. (1990). Psychische veränderungen als frühzeichen einer suboptimalen vitaminversorgung. *Ernährungs-Umschau*, 37, 87-94
- Jennings, P.D., McGinnis, D., Lovejoy, S. & Stirling, J. (2000). Valence and arousal ratings for Velten Mood Induction statements. *Motivation and Emotion*, 24 (4), 285-297.
- Jensen, R.S., & Adrion, J. (1985). *Third Symposium on Aviation Psychology*. Columbus, OH: Ohio State University.
- Johnson, M.H. & Margaro, P.A. (1987). Effects of mood and severity on memory processes in depression and mania. *Psychological Bulletin*, 101, 28-40.
- Kenealy, P.M. (1986). The Velten Mood Induction Procedure: A methodological review. *Motivation and Emotion*, 10 (4), 315-335.
- Krahenbuhl, G.S., Darst, P.W., Marett, J.R., Reuther, L.C., Constable, S.H., Swinford, M.E. & Reid, G.B. (1981). Instructor pilot teaching behavior and student pilot stress in flight training. *Aviation Space and Environmental Medicine*, 52, 594- 598.
- Kwiatkowski, S.J. & Perkinson, S.R. (1994). Depression, elaboration, and mood congruence: Differences between natural and induced mood. *Memory and Cognition*, 22 (2), 225-233.
- Leigh, K.A. & Ellis, H.C. (1981). Emotional mood states, strategies, and state- dependency in memory. *Journal of Verbal Learning and Verbal Behavior*, 20, 251-266.

- Lewis, V.E. & Williams, R.N. (1989). Mood-congruent vs. mood-state-dependent learning: Implications for a view of emotion. *Journal of Social Behavior and Personality*, 4(2), 157-171.
- Loke, W.H., Hinrichs, J.V., & Ghoneim, J.J. (1985). Caffeine and diazepam: Separate and combined effects on mood, memory and psychomotor performance. *Psychopharmacology*, 87 (3), 344-350.
- Martin, L.L. & Clore, G.L. (Eds.). (2001). *Theories of mood and cognition: A user's guidebook*. Mahwah: Lawrence Erlbaum Associates.
- McDaniel, M.A., Gilles, O.E., Dunay, P.K. & Cobb, R.E. (1986). Encoding difficulty and memory: Toward a unifying theory. *Journal of Memory and Language*, 25, 646-656.
- Mish, F.C., & Morse, J.M. (Eds.). (1994). *Merriam Webster Dictionary*. Springfield, MA: Merriam- Webster, Inc.
- Mueller, J.H. (1978). The effects of individual differences in test anxiety and type of orienting task on levels of organization in free recall. *Journal of Research in Personality*, 12, 100-116.
- Parrott, W.G., Sabini, J. (1990). Mood and memory under natural conditions: Evidence for mood incongruent recall. *Journal of Personality and Social Psychology*, 59 (2), 321-336.
- Picano, J.J. & Edwards, H. F. (1996). Psychiatric syndromes associated with problems in aeronautical adaptation among military student pilots. *Aviation Space and Environmental Medicine*, 67 (12), 1119-1123.
- Searleman, A., & Herrmann, D. (1994). *Memory from a broader perspective*. Boston: Mc Graw- Hill.
- Seibert, P.S., & Ellis, H.C. (1991). A convenient self-referencing mood induction procedure. *Bulletin of the Psychonomic Society*, 29, 121-124.
- Seta, C.E., Hayes, N.S., & Seta, J.J. (1994). Mood, Memory, and Vigilance: The Influence of Distraction on Recall and impression Formation. *Personality and Social Psychology Bulletin*, 20 (2), 170-177.
- Squire, L., Byrne, J.H., Nadel, L., Roediger, H.L., Schacter, D.L., & Thompson, R.F. (Eds.). (1992). *Encyclopedia of Learning and Memory*. New York: Macmillan.

- Stevenson, R.J. (1981). Depth of comprehension, effective elaboration, and memory for sentences. *Memory and Cognition*, 9 (2), 169-176.
- Telfer, R., & Biggs, J. (1988). *The psychology of flight training*. Ames: Iowa State University Press.
- Tessonneau, G. (1973). Adaptation et inadaption en Ecole elementaire de pilotage. *Revue de Medecine Aeronautique et Spatiale*, 49, 32-36.
- Tilley, A. & Warren P. (1983). Retrieval from semantic memory at different times of day. *Journal of Experimental Psychology: Learning Memory and Cognition*, 9 (4), 718-724.
- Tyler, S. W., Hertel, P.T., McCallum, M.C. & Ellis, H.C. (1979). Cognitive Effort in Memory. *Journal of Experimental Psychology- Human Learning and Memory*, 15 (6), 607-617.
- United States Department of Transportation. (1980). *Flight training handbook*. Washington, D.C: U.S. Government Printing Office.
- United States Department of Transportation. (1997). *Pilot's handbook of aeronautical knowledge*. Washington, D.C: U.S. Government Printing Office.
- United States Department of Transportation. (1999). *Airplane flying handbook*. Washington, D.C: U.S. Government Printing Office.
- United States Department of Transportation. (1999). *Aviation instructors handbook*. Newcastle, WA: Aviation Supplies & Academics, Inc.
- United States Department of Transportation. (2002). *FAR/AIM 2002*. Newcastle, WA: Aviation Supplies & Academics, Inc.
- Velten, E.J. (1968). A Laboratory Task for induction of mood states. *Behavior Research and Therapy*, 6, 473-482.
- Wagata, D.K. & Trierweiler, S.J. (1988). Exploring the effects of mood checklist pretesting on experimental mood induction procedures. *Personality and Social Psychology Bulletin*, 14 (1), 125-135.
- Weingartner, H., Miller, H., Murphy, D.L. (1977). Mood-State-Dependent Retrieval of Verbal Associations. *Journal of Abnormal Psychology*, 86 (3), 276-284.
- Weingartner, H., Cohen, R.M., Murphy, L., Martello, J. & Gerdt, C. (1981). Cognitive processes in depression. *Archives of General Psychiatry*, 38, 42-47.

- Westerman, R., Spies, K., Stahl, G. & Hesse, F.W. (1996). Relative effectiveness and validity of mood induction procedures: A metanalysis. *European Journal of Social Psychology*, 26, 557-589.
- Wetzler, S. (1985). Mood state-dependent retrieval: A failure to replicate. *Psychological Reports*, 56, 759-765.
- Zuckerman, M. & Lubin, B. (1965). *Manual for the Multiple Affects Adjective Checklist*. San Diego, CA: Education and Industrial Testing Service.

Appendix A

Recruitment Script

Recruitment Script

A graduate student in the Human Factors and Systems program is currently conducting a study on mood dependent learning in student pilots. She is looking for male and female student pilots who are working towards their private pilot license. In order to participate in the test, the student pilot must have either a first, second or third class pilot medical certificate. The study will take about one hour.

Does it ever seem like it is really difficult to learn when you are feeling down? Do you think it is hard to sit through ground lessons and class when you are having a bad day? This investigation is attempting to explore these ideas and explain why it may be difficult to learn and remember aviation- based material when you are in a sad mood state.

Although you could possibly feel a little bit sad during the experiment, the experimenter will ensure that you will not leave the test site in a bad mood!

Come volunteer and discover some factors which may affect your memory.
Please come on time and well rested.

Date:

Time:

Location:

* Pass around E-mail sign up form.

Appendix B

Consent Form

The Effects of Mood on Student Pilot Learning

Consent Form

Conducted by Angela S. Wendell
Embry-Riddle Aeronautical University
Master of Science in Human Factors and System

The experiment in which you are about to participate is designed to investigate the effect of mood on student pilot learning. The experiment will consist of a series of directions, surveys and questionnaires. During the course of the experiment, you will be asked to refrain from all conversation, and to follow the written instructions as carefully as possible. All of the individual results will be kept confidential. The entire experiment will take approximately one hour.

There are no known long-term risks associated with this experiment. You will be compensated for your time spent participating in the study, as set by the terms of your individual instructor. The participation information for your instructor will be gathered at the completion of the experiment. You may terminate your participation in this study at any time if you wish. If you chose to terminate the study early, you will receive an adjusted level of credit from your instructor based on the time spent participating.

Thank you for your participation and involvement in this study. If you have any questions or would like to learn about the results of the study, please feel free to contact me, Angela, at (386) 589-3443.

Statement of Consent

I acknowledge that my participation in this experiment is entirely voluntary and that I am free to withdraw from the experiment at any time. **I understand that all of my personal information and results will be kept confidential.** I also agree to notify the experimenter at the end of the session if I have any concerns or problems.

I have been informed as to the general purpose of this experiment, and understand that I will receive credit for my participation based on the agreement set forth by my classroom instructor. If I chose to withdraw from the study early, I understand that I will receive credit for the amount of time that I have spent participating.

Participant's name (please print) _____

Signature of participant _____ Date: _____

Experimenter: _____ Date: _____

Appendix C

Initial Student Questionnaire

Please complete the following questions and tear off the bottom part of this paper to remember your number:

1.) How old are you? _____

2.) Are you: Male_____ Female_____

3.) Are you: Married_____ Unmarried _____

4.) Are you a student pilot working towards a private pilot license?

Yes____ No____

3.) Do you currently have a first, second or third class pilot medical certificate?

Yes____ No____

4.) How would you describe your knowledge of **complex/ advanced** aircraft performance, systems and operations?

I don't know very much about **complex/ advanced** aircraft performance, systems and operations _____

I know a little bit about **complex/ advanced** aircraft performance, systems and operations _____

I feel that I have an extensive degree of knowledge about **complex/ advanced** aircraft performance, systems and operations _____

Please feel free to add any comments _____

Please tear off this portion of the paper. The number below is your number. You will write this number on every paper throughout the experiment:

YOUR NUMBER IS _____

Appendix D

Beck Depression Inventory

Participant Number _____

Please circle the number next to the sentence that most closely describes how you are feeling at this moment.

A. (Mood)

- 0 I do not feel sad.
- 1 I feel blue or sad.
- 2 I am blue or sad all the time and I can't snap out of it.
- 2 I am so sad or unhappy that it is very painful.
- 3 I am so sad or unhappy that I can't stand it.

B. (Pessimism)

- 0 I am not particularly pessimistic or discouraged about the future.
- 1 I feel discouraged about the future.
- 2 I feel I have nothing to look forward to.
- 2 I feel that I won't get over my troubles.
- 3 I feel that the future is hopeless and that things cannot improve.

C. (Sense of Failure)

- 0 I do not feel like a failure.
- 1 I feel I have failed more than the average person.
- 2 I feel I have accomplished very little that is worthwhile or means anything.
- 2 As I look back on my life all I can see is a lot of failures.
- 3 I feel I am a complete failure as a person (parent, husband, wife, etc.)

D. (Lack of Satisfaction)

- 0 I am not particularly dissatisfied.
- 1 I feel bored most of the time.
- 1 I don't enjoy things the way I used to.
- 2 I don't get satisfaction out of anything anymore.
- 3 I am dissatisfied with everything.

E. (Guilty Feeling)

- 0 I don't feel particularly guilty
- 1 I feel bad or unworthy a good part of the time.
- 2 I feel quite guilty.
- 2 I feel bad or unworthy practically all the time now.
- 3 I feel as though I am very bad or worthless.

F (Sense of Punishment)

- 0 I don't feel I am being punished.
- 1 I have a feeling that something bad may happen to me.
- 2 I feel I am being punished or will be punished.
- 3 I feel I deserve to be punished.
- 3 I want to be punished

G (Self Hate)

- 0 I don't feel disappointed in myself.
- 1 I am disappointed in myself.
- 1 I don't like myself.
- 2 I am disgusted with myself.
- 3 I hate myself.

H (Self Accusation)

- 0 I don't feel I am any worse than anybody else.
- 1 I am very critical of myself for my weaknesses or mistakes.
- 2 I blame myself for everything that goes wrong.
- 2 I feel I have many bad faults.

I (Self-Punitive Wishes)

- 0 I don't have any thoughts of harming myself.
- 1 I have thoughts of harming myself but I would not carry them out.
- 2 I feel I would be better off dead.
- 2 I have definite plans about committing suicide.
- 2 I feel my family would be better off if I were dead
- 3 I would kill myself if I could.

J (Crying Spells)

- 0 I don't cry any more than usual.
- 1 I cry now more than I used to.
- 2 I cry all the time now. I can't stop it.
- 3 I used to be able to cry but now I can't cry at all even though I want to.

K (Irritability)

- 0 I am no more irritated now than I ever am.
- 1 I get annoyed or irritated more easily than I used to.
- 2 I feel irritated all the time.
- 3 I don't get irritated at all at the things that used to irritate me.

L (Social Withdrawal)

- 0 I have not lost interest in other people.
- 1 I am less interested in other people now than I used to be.
- 2 I have lost most of my interest in other people and have little feeling for them.
- 3 I have lost all my interest in other people and don't care about them at all.

M (Indecisiveness)

- 0 I make decisions about as well as ever.
- 1 I am less sure of myself now and try to put off making decisions.
- 2 I can't make decisions any more without help.
- 3 I can't make any decisions at all anymore.

N (Body Image)

- 0 I don't feel I look any worse than I used to.
- 1 I am worried that I am looking old or unattractive.
- 2 I feel that there are permanent changes in my appearance and they make me look unattractive.
- 3 I feel that I am ugly or repulsive looking.

O (Work Inhibition)

- 0 I can work about as well as before.
- 1 It takes extra effort to get started at doing something.
- 1 I don't work as well as I used to.
- 2 I have to push myself very hard to do anything.
- 3 I can't do any work at all.

P (Sleep Disturbance)

- 0 I can sleep as well as usual.
- 1 I wake up more tired in the morning than I used to.
- 2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
- 3 I wake up early every day and can't get more than 5 hours sleep.

Q (Fatigability)

- 0 I don't get any more tired than usual.
- 1 I get tired more easily than I used to .
- 2 I get tired from doing anything.
- 3 I get too tired to do anything.

R (Loss of Appetite)

- 0 My appetite is no worse than usual.
- 1 My appetite is not as good as it used to be.
- 2 My appetite is much worse now.
- 3 I have no appetite at all any more.

S (Weight Loss)

- 0 I haven't lost much weight, if any, lately.
- 1 I have lost more than 5 pounds.
- 2 I have lost more than 10 pounds.
- 3 I have lost more than 15 pounds.

T (Somatic Preoccupation)

- 0 I am no more concerned about my health than usual.
- 1 I am concerned about aches and pains *or* upset stomach *or* constipation *or* other unpleasant feelings in my body.
- 2 I am so concerned with how I feel or what I feel that it's hard to think of much else.
- 3 I am completely absorbed in what I feel.

U (Loss of Libido)

- 0 I have not noticed any recent change in my interest in sex.
- 1 I am less interested in sex than I used to be.
- 2 I am much less interested in sex now.
- 3 I have lost interest in sex completely.

Please add up all of the numbers you have circled and write the total below:

Total Score _____

Please double check and add up the numbers one more time:

Total Score _____

* This score should be the same as the first score.

Appendix E
Velten Mood Statements

Velten Mood Induction Statements: One statement will be on each card.

Neutral Statements:

- 1.) Utah is the Beehive state.
- 2.) Some say that lady bugs are good for the garden.
- 3.) You have to take the ferry to get to the island.
- 4.) The Pacific Ocean has many types of fish.
- 5.) The reefs along the coast are made of coral.
- 6.) The desert climate is hot and dry.
- 7.) The eucalyptus tree was the largest on the block.
- 8.) Sometimes chimps have been taught to do sign language.
- 9.) New Mexico is in the United States.
- 10.) Savannah is in the state of Georgia.
- 11.) Most oil paintings are done on canvas.
- 12.) A neuron fires rapidly.
- 13.) All the children were playing on the swings.
- 14.) Corn is sometimes called maize.
- 15.) Arizona has both deserts and pine-covered mountains.
- 16.) Apples are harvested in the fall.
- 17.) An orange is a citrus fruit.
- 18.) Basket weaving was invented before pottery making.
- 19.) He played basketball yesterday morning.
- 20.) Scottish dancers perform to the music from bagpipes.
- 21.) Sacramento is the capital of California.
- 22.) Most high schools have a band.
- 23.) The nightclub had a female vocalist and a live band.
- 24.) It snows in Idaho.
- 25.) Mules hauled the supplies up the mountain.
- 26.) Some baseball bats are made from the wood of ash trees.
- 27.) She walked over to the shop and knocked on the door.
- 28.) Santa Fe is the capital of New Mexico.
- 29.) The roof was covered with leaves.
- 30.) Oranges contain Vitamin C.
- 31.) Elephants carried the supplies.
- 32.) The teacher spoke slowly.
- 33.) Diamonds really can cut glass.
- 34.) The rug was made according to an old Navajo pattern.
- 35.) The movie theater was located downtown.
- 36.) The Gulf Islands are in British Columbia.
- 37.) Some think that electricity is the safest form of power.
- 38.) Olympia is the capital of the state of Washington.
- 39.) Perennials bloom every year.
- 40.) Many buildings in Washington are made of marble.

Depression Statements:

- 1.) My classes are harder than I expected.
- 2.) My mistakes haunt me; I've made too many.
- 3.) I'm discouraged and unhappy about myself.
- 4.) Sometimes I feel like I will never succeed.
- 5.) I am unhappy with many of the choices I have made in life.
- 6.) Sometimes I am so lazy.
- 7.) I have been really hurt by people in the past.
- 8.) Sometimes I don't know what I really want out of life.
- 9.) I feel so tired and sluggish sometimes.
- 10.) I don't know if I will ever truly succeed.
- 11.) It takes me too long to make certain decisions.
- 12.) Nobody knows how sad I feel sometimes.
- 13.) So many things don't turn out the way I wanted.
- 14.) I'm completely alone.
- 15.) Every now and then I feel so tired and gloomy that I'd rather just sit than do anything.
- 16.) I have too many bad things in my life.
- 17.) My parents don't know who I am.
- 18.) I'm tired of trying.
- 19.) It doesn't seem like anything will ever be better,
- 20.) Nobody understands me or even tries to.
- 21.) Many times I feel sad or lonely.
- 22.) Every time I turn around, something else has gone wrong.
- 23.) Everyone else seems to be having more fun.
- 24.) I feel like I am being suffocated by the weight of my past mistakes.
- 25.) I feel cheated by life.
- 26.) When I talk, no one really listens.
- 27.) Sometimes I feel really guilty about the way I have treated my parents.
- 28.) I doubt that I'll ever make a contribution in the world.
- 29.) I don't think things are ever going to get better.
- 30.) Today is one of those days when everything I do is wrong.
- 31.) There is no hope.
- 32.) I am not rewarded for all I do.
- 33.) Why should I try when I can't make a difference anyway.
- 34.) Life is such a heavy burden.
- 35.) I wish I could be by myself, but nobody likes me when I am.
- 36.) Even when I give my best effort, it just doesn't seem to be good enough.
- 37.) Sometimes I feel so guilty that I can't sleep.
- 38.) What's the point of trying?
- 39.) I feel like my life's in a rut that I'm never going to get out of.
- 40.) I feel worthless.

Elation Statements:

- 1.) I know if I try I can make things turn out fine.
- 2.) My future is so bright I've got to wear shades.
- 3.) I'm going to have it all!
- 4.) My parents brag about me to their friends.
- 5.) Nothing can bum me out now.
- 6.) When I have the right attitude, nothing can depress me.
- 7.) I can make things happen.
- 8.) It's great to be alive.
- 9.) I know I can do it; I'm going to seize the day!
- 10.) The world is full of opportunity and I'm trying to take advantage of it.

Appendix F
Complex Aviation Sentences

Lesson Sentences:

Complex Aircraft Systems, Performance, and Operations

B.S. = Base Sentence

E.S. = Elaborative sentences (serve to make the target word more distinctive and easier to remember.)

Underlined words = target words which the student must remember (they will not know which word they are required to remember while reading the sentences initially.)

- 1.) **B.S.** The safest and most efficient climb procedure in a light twin, on the ground accelerating to rotation speed, is to accelerate to an airspeed slightly above V_{MC} .

E.S. The safest and most efficient climb procedure in a light twin, on the ground accelerating to rotation speed, is to accelerate to an airspeed slightly above V_{MC} and then lift off and climb at the best rate of climb airspeed.

- 2.) **B.S.** Use V_{YSE} if engine failure occurs.

E.S. Use V_{YSE} if engine failure occurs at an altitude above the single-engine ceiling.

- 3.) **B.S.** For an engine out landing in a multiengine airplane, procedures should be almost identical.

E.S. For an engine out landing in a multiengine airplane, procedures should be almost identical to the normal approach and landing.

- 4.) **B.S.** As air pressure decreases, thrust output decreases in a turbine- engine airplane.

E.S. As air pressure decreases, thrust output decreases due to higher density altitude.

- 5.) **B.S.** The equivalent shaft horsepower of a turboprop engine is a measure of jet thrust.

E.S. The equivalent shaft horsepower of a turboprop engine is a measure of shaft horsepower and jet thrust.

- 6.) **B.S.** In the event of a compressor stall, one should reduce fuel flow.

E.S. In the event of a compressor stall, one should reduce fuel flow, reduce angle of attack, and increase airspeed.

- 7.) **B.S.** Freezing point depressant fluids are intended to provide protection the ground only.

E.S. Freezing point depressant fluids, used for deicing, are intended to provide ice protection on the ground only.

- 8.) **B.S.** ATC may request a turbine-powered aircraft operating below 10,000 feet to reduce airspeed.

E.S. ATC may request a turbine-powered aircraft operating below 10,000 feet to reduce airspeed to as low as 210 knots.

9.) **B.S.** Leading-edge slots and slats direct air from under the leading edge.

E.S. Leading-edge slots and slats direct air from the high-pressure area under the leading edge along the top of the wing and delay airflow separation to some higher angle of attack.

10.) **B.S.** Wing mounted vortex generators reduce the drag caused by supersonic airflow.

E.S. Wing mounted vortex generators reduce the drag caused by supersonic airflow over the portion of the wing.